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ON THE POSITION OF GEOGRAPHY IN THE BRITISH UNIVERSITIES*

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IT seems to me that the best way to make clear the present position of geography in British universities will be to proceed historically. The history of the subject in these universities is a brief one. The first successful movement made with the view of getting university recognition for the subject was made by the Royal Geographical Society of London about 1885. It may be of interest to mention here that one of the most earnest leaders in this movement was Mr. James Bryce, lately the British ambassador at Washington, whose interest in geography has been manifested in many ways. The first step taken by the Society was to send a commissioner to the continent of Europe to ascertain how the subject was being dealt with there both in the schools and universities. The commissioner appointed was Dr. Scott Keltie, at that time the sub-editor of *Nature*, now secretary to the Royal Geographical Society, and I may mention that much of the most valuable material for his report was obtained from a visit to the geographical department of Professor Partsch then at Breslau. The publication of Dr. Keltie's report greatly stimulated the agitation for the introduction of the subject into the two ancient universities of Oxford and Cambridge, and not long after (in 1887 and 1888, respectively) readerships were founded in each of these universities, the Royal Geographical Society making in each case a contribution to the salary of the reader. Since then the recognition of the subject in British universities has steadily increased, and in the teaching of the subject the two ancient universities have maintained the lead.

Of the two, however, it is I think unquestionable that it is the Oxford school of geography that holds the first rank, and accordingly some details with regard to it may be of interest. The first reader appointed was Mr. H. J. Mackinder, whose name has long been well known in the geographical world, and it may be mentioned that he was probably the first man in the British Isles deliberately to qualify himself for a career in geography in the hope of that becoming a university career. It was with a view to that that when he took his degree at Oxford he did so by combining the

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subjects of science and history, a combination then looked upon as quite extraordinary. Mr. Mackinder retained the readership in geography for more than ten years, and was then succeeded by Mr. A. J. Herbertson, who had qualified for his doctor's degree in a German university by a thesis belonging to the field of climatology, and who for some time acted as assistant reader. Mr. Herbertson still holds the readership, but with that he has now held for more than a year the title of professor of geography. Meantime the school has grown to such an extent that there are now connected with it four teachers who give their whole time to it, the professor and reader, the assistant to the professor, and two demonstrators in geography. There are also a lecturer on ancient historical geography, an instructor in surveying, and another tutor who gives part of his time to the work of the school.

The students at the school are mainly teachers, many of them graduates, but there are also intending candidates for the Indian Civil Service and other examinations. The recognition given to successful students is a university diploma in geography, which is conferred after the passing of two examinations, generally after a two years' course of instruction. Part I embraces a written examination in general and regional geography, general geography comprising physiography, climatology, with a general knowledge of the distribution of plants, animals and man, and regional geography, a general knowledge of the geography of the world more particularly of British lands. Part II involves a written and oral examination in two selected subjects, and the preparation of a monograph on a small area of country, usually the area comprised in one sheet of the one-inch ordnance survey map, based on documents and personal observation, and illustrated with maps, diagrams, etc. The list of subjects from which the candidate may make his selection of two is the following: (1) Special regional geography, involving the study of some country in detail from original source; (2) climatology; (3) geomorphology; (4) biogeography; (5) economic and political geography; (6) modern historical geography; (7) ancient historical geography; (8) history of geography.

At Cambridge the development of the subject has followed somewhat similar lines, but there are some differences to note. There is no professor of the subject at Cambridge and no head of the department. For the last few years there have been two readers in the subject, and they, I understand, are co-ordinate. The first reader appointed was an explorer, and after a short tenure of office by him he was followed by a chemist (Mr. J. Y. Buchanan, the chemist to the *Challenger* expedition). He also held office for a short time, when he was succeeded by one of the present readers, Mr. Yule Oldham, who had studied for a time under Baron Richthofen at Leipzig, and who has specially concerned himself with the history of geography. When a second reader came to be appointed it was a geolo-

gist that was nominated to the post. As at Oxford there are also teachers of surveying and other branches of geography who give part of their time to the work of the school. A university diploma in geography is conferred on somewhat similar conditions to those obtaining at Oxford, but without the exaction of any geographical monograph, unless that has come to be required since the time when I had any connection with the examination for the diploma.

In no other British university, so far as I am aware, is any special qualification in geography granted. The subject, where it is recognized at all, is recognized only as one of several subjects included in the examination for a degree whether in science or in arts. The next university to adopt the subject was the old Victoria University, which had affiliated to it as constituent colleges Owen's College, Manchester, and the University Colleges of Liverpool and Leeds. The lecturer on the subject, first appointed in 1892, was attached to Owen's College. All the three cities mentioned have now separate universities, and each of these has a lecturer on geography. The one first appointed (1903) was that at Manchester, where the lecturer appointed was one who had given his chief attention previously to history, though he had also had training at the Oxford School of Geography. Liverpool followed Manchester in 1904, and to that university also the Oxford school furnished the lecturer. Both at Manchester and Liverpool the subject of geography is recognized in degrees in arts and in commerce. The lecturer on geography at Leeds was appointed only this year, the nominee in this case coming from the London School of Economics, and being, I understand, one who has hitherto given his attention chiefly to railway transport. A few years previously, in 1908, another northern university, that of Sheffield, had appointed a lecturer on geography, and in this case a botanist was appointed.

Long before this London also had recognized the subject. This recognition was given under the Act of 1898, which first created a teaching university in London, and which came into operation in 1900. The University of London as then constituted is a very complicated organization, which includes a number of teaching institutions affiliated to it, but also recognizes some teachers as teachers of the University whose courses are given in institutions not so affiliated. The act of foundation recognized only one teacher in the subject of geography, and he was a teacher of economic geography in one of those institutions, and was attached under the act to the faculty of science (economics and political science). There are now at least four recognized teachers of the subject in the University, two of whom belong to the London School of Economics, one of the teaching bodies affiliated to the University, whose aim is to associate university teaching as intimately as possible with the business life of the people. The subject of geography is one of the qualifying subjects for the degree of

bachelor of science (economics) and that of master of arts in the University. This year the University of London conferred for the first time in any British university the degree of doctor of science in geography for a thesis on the "Climatic Limits of Wheat Cultivation."

The only other English university which has a lecturer on geography is Birmingham, where there has been a lecturer for several years, but I am unfortunately unable to give any particulars about the subject there. I ought to add, however, that the subject is well represented at the University College of Reading, where the professor of the subject is the well-known meteorologist, Dr. H. N. Dickson. The college is in some respects one of the best equipped for the teaching of economic geography. In the University of Wales there is a lecturer on geography at Aberystwith.

In Scotland a movement for the establishment of a professorship of geography at Edinburgh was started nearly thirty years ago at the time of the foundation of the Scottish (now the Royal Scottish) Geographical Society in 1884. The movement made little progress and soon fell dead, but the demand for the university representation of the subject became so persistent and strong that the University was at last in 1908 obliged to found a lectureship on the subject out of its own funds. The lecturer thus appointed is what is known as a lecturer, head of a department; that is, he has all the duties and responsibilities, but does not enjoy some of the more important privileges of a professor. He is generally appointed for a term of five years, and reappointed for successive terms of the same length. The lecturer then appointed, who still holds the appointment, was one who had devoted most of his attention to economic and historical geography. In the following year a similar appointment was made at Glasgow, but there the first nominee, Dr. H. G. Lyons, formerly head of the Survey Department in Egypt, held office for only a short time, and was succeeded by Dr. Falconer, whose special training had been as a geologist.

Neither at Edinburgh nor Glasgow was the subject associated in the first instance with the faculty of science. In both it is connected with the faculty of arts, and in Edinburgh also with the faculty of history and law, and in both universities it is a qualifying subject for a degree in arts. Recently it has become associated in Glasgow but it is not yet in Edinburgh with the faculty of science, and it is now one of the optional qualifying subjects in Glasgow for the degree of B.Sc. The only honors degree in which geography holds a place in Edinburgh is one in economics.

In the Scottish universities the traditional mode of teaching is for the most part by means of lectures, and that holds good of geography in both the universities mentioned. In what is known as the ordinary class, attendance on which is required of those who take the subject with a view to a degree examination, there are about seventy-five lectures distributed over three terms. At Edinburgh more than half the lectures are devoted

to mathematical, physical, and other branches of general geography as a fundamental requisite for the study of regional geography. The remainder of the course is devoted to regional geography, which is treated in connection with the general course of the development of western civilization that arose on the plains of Mesopotamia and in the valley of the Nile, which gradually embraced the whole circuit of the Mediterranean, passed across the Alps to the Atlantic and the Arctic Ocean, and was carried by Europeans to America and Australia. The idea governing this mode of treatment is that the value of geographical conditions varies with the circumstances of the time, so that these circumstances must always be borne in mind where the aspect of geography that is studied is that concerned with geographical influences. Besides the lectures there is at both universities practical work—in Edinburgh about eighteen hours in the session mainly devoted to exercises in mathematical geography, climatology, and map drawing. The students are for the most part either teachers or in preparation for the teaching profession, the proportion of acting teachers in the class at Edinburgh (I do not know how it may be at Glasgow) being as yet large, owing to the recent foundation of the lectureship.

I understand that there are two professors of geology in Ireland, one at the Queen's University of Belfast and the other at Cork, one of the colleges of the National University of Ireland, who are also professors of geography, but I know nothing of the nature of their courses in that subject.

From this account, I think one fact will be seen to stand out very strikingly, namely, that the subject of geography in the British universities has been approached from very different sides, and it was for this reason that I have thought it well to make my contribution to this afternoon's proceedings of a historical nature. It will also be apparent that the subject is steadily and even rapidly obtaining greater and greater recognition, and I think I may add that this greater recognition does not consist merely in its being more generally adopted as a university subject, but also in securing for itself greater respect in the universities into which it has been introduced. One other general remark I may make in conclusion, but this I do with less confidence. It seems to me that the underlying conception of geography as it is most generally taught in the British universities is that of the study of the influence, especially on man, direct or indirect, of local conditions and place relations. I do not say that the various teachers of geography would adopt that as a definition of their subject or recognize it as indicating the scope of their teaching; yet it seems to me that an analysis of the great majority of questions set in university examinations would bear out the statement I have ventured to make. It will be manifest on reflection that the conception indicated involves the careful study of nearly everything that is usually taught under the heads of mathematical and physical geography.

THE AGE OF THE EARTH

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LET us suppose that Methuselah, still hale and hearty, celebrated his seven hundredth birthday by moving out of the somewhat delapidated hut he had been occupying for the century or two of his later middle life and taking up his abode in a new cabin, improved by all the housekeeping inventions of one or two hundred years. Let us then suppose that, a few years later, a passing stranger stopped at the cabin door, and, being impressed by Methuselah's venerable appearance, asked him how old he was. Would it be fair for Methuselah to measure his age by the few years that he had lived in his new cabin, and answer, for example, "Seven?" Would not his age really have been, seven hundred and seven? Surely the age of a man is measured by the duration of his individual existence, not by the time since he has been living in one house or another, or doing this or that.

The same is true of a planet, and for that reason, one must dissent from all the figures cited in a recent article in the *Journal of Geography* (XII, 1913, 16-18), as answers to the question: "How old is the Earth?" All the measures of age there quoted correspond to Methuselah's unfair answer, as above pretended. The measures are interesting, but the title of the article is wrong. Joly's estimate was not of the age of the earth, but as the text states of the time "since the earth's surface cooled below the temperature of boiling water;" and indeed any estimate of that kind is of more value as an exercise in arithmetic than in geology, because its arithmetic is good while its geology is full of unproved assumptions, such for example as that the earth's surface once really had the temperature of boiling water. Kelvin's estimates all concern changes that are supposed to have taken place on or in the ready-made earth, and have nothing to do with its real age—that is, the measure of time since the earth began—as Kelvin knew perfectly well, but as some of his readers do not seem to realize. Estimates of the earth's age in years, based upon the thickness of sedimentary formations—purely superficial deposits formed by wearing detritus from one part and laying it down on another part of the ready-made globe—are like measurements of a full-grown man's age in terms of the time in seconds that it takes him to put on a suit of clothes. The expert investigators quoted in the above cited articles knew all this perfectly well; and the text of the article more or less explicitly corrects its title; but the title of the article is misleading, and readers of the article may get a wrong impression from it.

The real age of the earth is to be measured by the time since the earth began to take shape as a planet, in whatever way that misty process was accomplished. It has been supposed for a century or so to have been accomplished in a hot and nebulous way; it has later been shown to be eminently possible

in a cool and fragmentary way; but as to the rate at which either of these imagined processes began to form the planetary embryo and went on to build up the full-bodied earth, no one has the slightest idea. Studies of stars may possibly give astronomers ground for making hypotheses as to the rate of formation of suns; but it does not follow that planets are formed at the same rate.

The real age of the earth is today utterly incalculable. Instead of asking, "How old is the earth?" one must be content to ask, "How long have present geological processes been working on the earth?" Even then answers will be given, like those quoted, varying over hundreds of millions of years and changing with each advance in physics. Let those who must ask questions of this sort get what satisfaction they can out of the answers. They will not get very much, because like some other old ladies, Mother Earth does not seem inclined to reveal how long it is since she was somewhat younger.

But that is not my chief point. What I wish to emphasize is this: The age of the earth, as discussed in the article above cited, does not seem to me a well chosen subject for a journal of geography. What I here write is therefore somewhat in the nature of an open letter to the Editors of the *Journal,* with the object of urging them to limit the contents of their pages to the abundant subjects that fall more surely within the broad limits of our science. Of course, if geography were really nothing more than an *omnium gatherum*—as it too often seems to be—then the age of the earth, rules for the increase of the genitive in Latin nouns of the third declension, devices for the ready extraction of cube roots, newly recommended cures for rheumatism, and so on, would be pertinent materials for the pages of a geographical journal; but a journal thus filled would not be of much assistance in developing whatever real value geography may contain as a subject of school teaching. Geography however is, in the opinion of many teachers, not an indiscriminate *omnium gatherum;* it has some essential quality. It is, to be sure, variously defined by various writers, but in giving it a definition each writer strives to indicate that it possesses a central disciplinary object, whether he indicates at the same time the edges of its content or not. If the article on "How old is the Earth"? had been introduced with a discussion to show that in one way such a topic is appropriately geographical and in another way it is not, I should, as a regular reader of the *Journal,* have welcomed it; but its appearance without comment, just as if it were real geographical stuff, dissatisfies me even more than the use of a profoundly interesting question for its title; a question that is wholly cosmical, largely astronomical, hardly geological and not at all geographical in its bearings.

But now let me turn the problem around to its other side, and ask: "Do teachers of geography, to whom in the main the *Journal of Geography* is addressed, need or care to know anything about the age of the Earth?" Certainly they do. They certainly need to know and they ought to care to know that

the earth is at least old enough for the occurrence of those changes which have produced the present forms of its surface; that is, the forms which a geographer sees as he travels about the world. The earth is certainly old enough for the upbuilding of enormous volcanic cones, such as those of Rainier and Shasta; it is old enough for the erosion of deep valleys, like those of the Sierra Nevada, and even for the reduction of ancient mountains to mere stumps, such as are seen in the truncated structures of the Wisconsin highlands; old enough for a complicated succession of slow processes, as recorded in the tilting, carving, burial and resurrection of the rocks which, in consequence of these changes, appear in Baraboo ridge; or for the repeated planations and tiltings which determine the features today visible in the depths of the Colorado canyon.

Evidently, therefore, a teacher of geography may have abundant occasion to know that the earth is millions of years old at least; but like the directory-clerk who is satisfied with immediately practical details, such as one's name and address, rather than like the census-taker who inquires into the nativity of one's paternal and maternal grandparents, the geographer, who is engrossed in his own work, does not care and indeed has not time to take up any inquiry that is so distractingly difficult and so far irrevelant as "How old is the Earth?"

Geography is so embarrassingly broad and rich a subject and its content is so voluminous and so varied, that we are in danger of being weighed down under its essentials, even if we avoid all unnecessary responsibilities: if we take those also on our backs, we shall be crushed. Let the geographer strive to give truthful, vivid, intelligible pictures of the landscapes and districts and regions of the actual, visible, busy, living world. His own thoughts and his pupils' heads will be sufficiently filled therewith; there will be no time and no need to bring in other subjects.

This exhortation prompts me to mention a matter that has been in my mind, since reading certain "Economic Notes" in the *Journal* a time ago. For example; "The fiscal year 1910 was the first under the conditions of virtual free trade between the United States and the Philippines created by the Tariff Act of 1909. Total exports from the islands increased....." and so on. Let me first make it clear that, even apart from the important and difficult questions of policy here touched upon as between a governing home country and a governed distant possession, I recognize that the facts quoted must be of prime importance to some one, just as any large facts are of prime importance somewhere or other. I can easily conceive their pertinence in an advanced course on tariff legislation, or colonial policy, or economic statistics; but on the other hand I question whether they can be of use to a school teacher of geography, much less to a school pupil of geography. This doubt on my part may, however, very likely arise from my inattention to and ignorance of the economic side of geography; hence a practical suggestion that I should like to make is this: When a contributor of notes sends in his batch to the *Journal,*

let him indicate in some simple manner what he would regard as an appropriate relation and application of the included items to the standard central subject of geography, or to some of its important branches. The use of the notes by busy teachers would thus be facilitated. It may well be that many notes are chiefly of value as supplying advanced material for the strengthening of the teachers themselves, without any idea on the part of the contributor that these advanced matters should be passed on by the teachers to the pupils; but if such be the case, let the contributor say so, and thus reduce the embarrassment of the conscientious teacher, who on reading the notes may strive to apply them in a following lesson. It may also be the case that, in the opinion of the contributor, who it is assumed is much interested in the improvement of geographical teaching, the notes should be introduced in connection with some generally accepted and established subdivision of geography, in such or such grade of its progress; if this be the case, it would be helpful to give hints of this kind also.

In order to make practice of my preaching, let me revert to the geographical aspect of the earth's age, as above indicated, and close with the following suggestions as to how the truly geographical aspect of such a matter should enter into the actual teaching of geography in school.

First, as to school teachers: To them, a personal conviction that the earth is really old enough to have permitted the slow accomplishment of great works ought to have been grounded on the observation of simple, homely facts, of which nearly every normal school-district furnishes at least a fair supply; and the well grounded conviction ought to be extended and to be continually extending by observation of new facts encountered in ordinary vacation travel and by intelligent reading; but the chief thing is, that this conviction ought to be a vivid personal experience and not an authoritatively imposed belief. It is, I believe, of no practical value to nine teachers out of ten, to read that "Huxley and others denied the validity of Thompson's conclusions," or that "Kelvin narrowed his limits to Clarence King's estimate." That sort of reading tends to blind the reader. Such sentences are too much like the following quotations taken from an "Elementary Physiography": "Mr. R. H. Scott gives the following statements from Professor Mohn's 'Treatise on Meteorology' ", or "In Ganot's 'Treatise on Physics', as edited by Professor Atkinson, the following remarks are made." They make one tremble at what its author might include in an advanced book!

Next, as to school pupils: For them, the vast age of the geographical features of the earth may be, if the teacher so desires, directly imposed as a sort of wonder-story dealing with very large numbers, in which young people delight whether they can understand the story or not; and it may be briefly added that the earth is a great deal older still; but at the same time, the pupils should be shown simple and local indications of geographical earth-age in the neighborhood of the school, and such indications should be consciously regarded by

the teacher and unconsciously accepted by the pupils as the beginning of a great collection, to which each pupil ought to add all through his life. It is not easy to give general rules that will guide a teacher in work of this kind, because the work must depend on the local opportunity. Nevertheless the illuminating idea of the sufficient antiquity of the earth for the production of its visible features is one that ought to be planted early, so that it shall develop and expand all through the course of geographical study; not as the belief of some unknown learned men with whom the pupils have no personal acquaintance; not as a vague abstraction, disconnected from the experiences of every day life; but as a living truth, the evidence of which is plainly visible out doors; a truth with which the growing pupils should come into increasing contact as long as they live. Certainly any teacher ought to feel free to add the geological aspects of earth-age, if he desires too; but in so doing he ought not to think that he is teaching geography or that he is answering the question: How old is the Earth? The object of gaining some truly geographical understanding of a problem of this sort is, for teacher and pupil alike, not that it shall be locked up and neglected in some back corner of the memory, but that it shall enter more and more into the lively appreciation and if possible into the high enjoyment of the earth on which we must dwell.

SOME POINTS IN THE GEOGRAPHY OF SOUTH AMERICA

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The Continent as a Whole

EXTENT—In a north-south direction South America has an approximate length of 69 degrees or 4600 miles and a width of 46 degrees or 3200 miles. In extreme dimensions it is about 250 miles longer and 100 miles narrower than North America. It ranks fourth among the continents in size, seven million square miles being a round figure for its area. This is between an eighth and a seventh of the total land area of the globe. Triangular in shape, and largely lacking in coastal indentations, it is one of the most compact of the continents; its periphery is only about twice that of a circle of the same area.

Surface—Like its northern neighbor, South America has three main physiographic regions; (1) the eastern highlands, which are divided by the Amazon into two parts, those of Brazil and those of Guiana, and constituting about one seventh of the area of the continent; the Brazilian portion at present carries about one-third of the total population of South America. (2) The western highlands, made up of lofty parallel mountain ranges with plateau areas between. From latitude 14° S to 23° S these ranges are some 400 miles apart and between them is a plateau 100,000 square miles in area and averaging 12,000 feet in height. This plateau is the only considerable interior drain-

age basin, and, aside from the difference due to the greater elevation, it is comparable to our Great Basin. The Western highlands have twice the area of the eastern. (3) The central lowlands make up approximately one-half of the continent's area. This vast plains region extends the length of the continent and has three distinct sections bordering on the ocean.

In addition to these three main physiographic regions there are two smaller ones, the Atlantic slope with an area of about 150,000 square miles and the Pacific coastal slope of approximately 350,000 square miles. These vary in width from practically nothing to 100 miles, and their interior border is sufficiently abrupt to make the ascent into the interior difficult. Thus the early colonists of Brazil were confined to the coast in the same way that the English colonists were in eastern North America.

The average elevation of the continent is estimated at 2,000 feet, the same for North America. But South America has little land of moderate elevation. Two-fifths of its area does not exceed 600 feet above sea level as against one-third for North America and Europe, one-fourth for Asia, and a much smaller fraction for Africa and Australia. Then it goes to the other extreme, the fractional part of its area above 10,000 feet being greater than for any of the other continents.

Climate—South America is a two-zone continent and as such is limited in its climatic types. And since over five-sixths of its area lies within the tropics there is a relatively small portion where a variable climate may be expected. General storms, as we know them, are not encountered until the latitude of Buenos Aires is reached, so that a large percentage of the people do not know what a general storm is.

In the arrangement of its great mountain systems South America is fortunate; those ranges that are high enough to affect the rainfall greatly are on the lee side of the continent with reference to the winds, resulting in a relatively small amount of desert land. Close to four-fifths of the continent is at some time during the year within the trade wind zones and but one-sixth lies within the prevailing westerlies. This latter area, a little more than one-third as large as the United States, is the only part of the continent favored with the cyclonic type of storm.

There are places—notably northwestern Chile—where no rain falls for years, and others where the rainfall is excessive. For the continent as a whole the rainfall is ample, and there is the further advantage that the larger portion of the rain occurs during the growing season; indeed, in large areas the occurrence of the rains rather than the temperatures determines the growing season.

Temperatures are probably not as high in South America as we of north temperate latitudes generally suppose, nor are the highest temperatures there found near the equator. The average maximum recorded, 104° F., occurs in Paraguay. The average maximum for North America is 113° F. and that for

Asia is still higher. The average low temperatures for a given place are generally not as low as the latitude would warrant. The difficulty in the equatorial sections as regards temperatures is not so much a matter of extreme but rather of long continued heat with a high relative humidity. On the equatorial lowlands the daily range of temperature may be 20° F. or more, while the average annual range may be only half as much. Of such a region it has been said that the days are the seasons. Countries so situated are deprived of the invigorating effects of our seasonal variations. It is in this respect that the equatorial climate offers a serious drawback to occupancy by the white race.

Frost occurs throughout the length of the Andes; it occurs every year in the Brazilian highlands, and on the lowlands from central Argentina south.

The constant high temperature and the abundant rainfall which occur throughout large areas of South America give to it a most favorable type of climate for the growth of vegetation. Up to the present time the very luxuriance of plant life has been in many sections a serious drawback to their development. The native with his primitive tools is unable to keep the undesirable plants weeded out because of the very rapidity of their growth. Railroads within the rainy tropics find the task of keeping down the vegetation on their right-of-way a serious one.

The Soil—Where the land is cultivable the soil is said to be less fertile than in similar situations in this country. A large percentage is laterite, the residual soil from weathered granites; that of the lowlands of the Orinoco and of the Amazon is alluvium, and a relatively small amount is of glacial origin. But a soil of only average fertility in a region of ample rainfall and of uniformly high temperature throughout the year will produce abundantly. In the combination of soil, temperature, and rainfall South America has a potential agricultural productivity that will bear comparison with the most favored of the continents.

Agricultural Products—The extent in latitude and the range in elevation give to the continent a wonderfully wide range of agricultural products; in some places the whole gamut of crops may be run within a few miles. Thus, Ecuador produces bananas, rubber, cacao, coffee, sugar cane, cotton, maize, and wheat. The variety of products is well illustrated in the number of plants "useful for alimentary, medicinal, and industrial purposes South America has given to the world. They are the potato, manioc, yam, a species of bean, tomato, guava, mate, pineapple, epicacuanha, and tolu balm."

Mineral Resources—It was its wealth in precious metals that first drew Europeans into South America. While the value of gold and silver that the mines have yielded can never be known, it must have been enormous, since the silver mines of Potosi are estimated to have produced $1,500,000,000 since the Spanish occupation. "From 1540 to 1760, a period of 220 years, the gold mines of Bolivia produced $2,100,000,000." The baser metals are found in

great abundance also, but the deposits have not been exploited so extensively as have the gold and silver. Rich deposits of copper and iron are known to occur in Peru and Bolivia, and the rich iron ores of Brazil equal the best of the Lake Superior region in quality. So far as present knowledge goes the continent is poor in mineral fuels and their absence will doubtless always be a drawback to the industrial development of the nations there. The continent is unique in its great abundance of nitre deposits (nitrate of soda). Chile derives practically all the revenue necessary to maintain its government from the royalties on the nitre sent out of the country.

Communication—As with the other continents, so in the case of South America, there are factors that make for ease of outside communication and others that hinder it. Of the former may be mentioned (1) the facing of the continent toward the Atlantic, the ocean of commerce, (2) the deep penetration of the continent by three great river systems, (3) the low divides between these river systems, and (4) the position of the continental divide near the Pacific, one of the tributaries of the Amazon being navigable to within 350 miles of the latter ocean.

Of the unfavorable factors there are, (1) the isolation of the continent, (2) its general compactness, (3) the evenness of the coast line, (4) the paucity of good natural harbors, (5) the fact that the most desirable portions from the standpoint of habitability are the least accessible, and (6) the obstacles incident to a hot, moist climate, such as fevers and other diseases.

People—Until latitude 20° S is reached the greater number of the people are found on the plateaus, but from thence south the lowlands are the more populous. The great Amazon lowlands, a most productive region naturally, is the least thickly settled. Three of the Brazilian states situated in this section make up 52 per cent of that nation's area and but 5 per cent of its population. This grouping of the people with reference to the altitude is in the main a response to climatic conditions.

South America offers a most interesting study in the relations of the races. Of the total population of 45,000,000 reliable estimates give 9,000,000 pure Indians, 13,000,000 mestizo, or half breeds, 15,000,000 whites, and 9,000,000 negroes and mulattoes. Most of the blacks are in Brazil, but some are in Venezuela and Guianas.

While the Indian and the negro occupy a lower plane than the whites, it is not because of race but of condition for "the distinction between the races is in Spanish-American a distinction of rank rather than of color. Against intermarriage there is, therefore, no more feeling than that which exists against any union palpably below a man's or a woman's rank in life. Except perhaps in a few of the oldest cities, a mestizo counts as white. Thus one may say that there is no color question in South America." Because of the small percentage of the superior race, the result of the amalgamation of the races there going on must result in a people inferior to the whites. Of the better

class of South Americans it is said that "they are superior to us in the sense of beauty and the appreciation of the artistic and inferior in material development and public education."

Countries of South America

For present purposes a brief discussion of three of the South American nations that are fairly typical will suffice.

Brazil is one of the major countries of the world. As regards contiguous national territory it is exceeded only by Russia, China and Canada. It probably has more unexplored area and greater possibilities for future development than any other nation. The single state of Amazonas, which is but little explored and practically undeveloped, is larger than the combined areas of Great Britain, France, Germany and Italy.

Because of its situation on either side of the equator, Brazil has the least climatic range of any large country. Nine tenths of the total area lies within the tropics, and the climate of the extra-tropical section is very mild.

The narrow range of agricultural products which the mild climate would imply, are somewhat extended by the elevation of the highlands. Cotton and maize are grown successfully; and at present the authorities are encouraging in every way the production of wheat so as to stop the importation of flour. While the results so far are rather indifferent they are hardly conclusive. In time it may prove a strong competitor to the United States in cotton growing. Brazil takes first rank among the nations as a producer of rubber and of coffee, the latter being the more valuable. It produces 75 per cent of the world's coffee. In no other considerable nation does financial prosperity hinge upon a single crop so completely as it does in Brazil upon coffee. Coffee is said to form 90 per cent of the wealth of Sao Paulo, a state twice the size of Wisconsin.

About half the population of South America lives in Brazil, and of this half there is an "equality if not a preponderance of Negro blood." It is the only nation of the continent not settled by the Spaniards. One writer says of the Brazilians that they are lazy but ambitious, cordial, kindly, hospitable; that they could teach us much in the way of culture, of innate love of the artistic, and of the appreciation of beauty.

Argentina—Of the nations of South America Argentina is in many ways the most advanced. Though second in size it is but little more than one-third the area of Brazil. Commercially it ranks first.

A flat country with much grass land, Argentina early became a great cattle producing nation, and for some time it has been a strong competitor of the United States and of Australia in supplying Europe with meat. Of late years the percentage of land given over to cultivation has increased rapidly, the level nature of the country together with its treeless condition favoring the use of modern machinery for large scale cultivation. As an exporter of maize and of wheat it ranks first among nations, it having recently displaced the United States. In the cereal growing section but 14 per cent of

the available land is under cultivation and there yet remains 170,000,000 acres—five times the area of Wisconsin—to be developed. In view of her present rank as an exporter of maize and with so large an area yet to be given over to their cultivation and wheat, it appears that Argentina is destined for a long time to play an important part as an exporter of these crops.

Argentina has a sufficient range in climate to allow it to produce both tropical and temperate products, and agriculturally to become self sufficient.

Unfortunately the nation is poorly supplied with mineral fuels. The lack of these together with the large soil resources indicate that her interests are to continue to be of the agricultural sort. At present about 75 per cent of the total population is in the cereal region, which contains but one fourth the total area.

In Argentina we have an unusual case of a large, new agricultural country having a fifth of its total population in a single urban center. Turner says, in substance, that we have no cities in North America that can compare with Buenos Aires in cleanliness, city water supply, streets, and unity of architecture, and that very few European cities can compare with it.

Ecuador is typical of several of the South American nations. One way in which it stands as a type is its notoriously bad and unstable government. This naturally keeps away the capital that is so necessary for the development of the country.

Though situated in equatorial regions, because of its mountain and plateau areas, we find it producing temperate zone products in considerable quantities. Thus it produces practically all the wheat and corn, it needs. In addition it exports coffee, rubber, and one-third of the world's supply of cacao. Because of its range in altitude Ecuador has agricultural possibilities similar to those which Argentina derives from its range in latitude, that is, the ability to become self-sufficing agriculturally.

Ecuador is typical of equatorial South America in that the majority of its people live on the uplands. The hot, humid lowlands produce the more abundantly but the uplands are the healthier. Quito, a city of 80,000, is at an elevation of 9,000 feet, and it "is accounted by all travellers in what relates to climate and picturesquesness one of the most charming capitals of South America."

This is one of the South American nations that should be greatly benefitted by the Panama canal. The present all water route from New York to Guayaquil is 11,470 miles and requires 60 to 74 days; when the canal is opened this will be shortened to 2,900 miles and 8 or 9 days. The commercial stimulus which the canal will give to western South American nations will undoubtedly tend to make their governments more stable, which again will mean more production and more commerce.

THE SAONE-RHONE VALLEY

By FREDERICK HOMBURG,

Woodward High School, Cincinnati

THE united valley of these two rivers is of great importance, for it has been a north and south highway of nations, and for ages a trade route between the central highland region of France on the west and the Jura Mountains and the Alps on the east.

It communicates by low divides with the valleys of the Rhine, the Moselle, the Maas, the Seine and the Loire; to the east there are passes to Switzerland and to Italy; in the south the Riviera leads to Italy, the lowland of Languedoc to the valley of the Garonne, and further on along the coast and by passes in the Pyrenees, to Spain. How gentle the slopes of the northern divides are is shown by the fact that they are easily crossed by canals: the Rhine-Rhone canal leads to the Rhine, the Canal de l'Est to the Moselle, the Canal de Bourgogne to the Seine, and the Canal du Centre to the Loire.

Roscoe Conkling's saying that man treads the parallels of latitude is dazzling but not deep; the European migrations do not substantiate it. In southeastern France, armies and people moved in the direction of the meridian, along the path the waters had prepared. The Romans, the Teutons, the Suabians, the Burgundians, and long before these, still more ancient tribes all trod this valley; it figures in the Gallic campaign of Julius Caesar who crossed the Rhine-Rhone divide where Belfort now stands, and toward the Rhine he defeated the Germans under Arovistus. Early in 1871 along the same line the French under Bourbaki made an unsuccessful attempt to draw the German beseigers from Paris. Naturally, this water course is a very ancient trade route. In the days of the Phoenicians this valley was the road for amber and for tin. In the Middle Ages Marseilles was far more than a port of France; for the markets of Troyes and other places in the Champagne, and later those of Lyons, owed their importance and success not only to peace and good management, but more largely to position and accessibility. At these fairs, northern products from England, Germany, Scandinavia, and the Baltic could be exchanged for goods from the south and spices from the east, brought from the Mediterranean via the valley; while the money transactions and the loans arranged made these places in their day the exchanges of the world. The discovery of America and of a water route to India lessened the importance of the Mediterranean and of the Rhone valley; but their prestige was restored in our day when, by the cutting of the Suez Canal, the Mediterranean again became a chief artery of commerce. The Saone-Rhone valley is now used by the Paris-Lyons Mediterranean Railroad (the P. L. M. R. R.)—the largest and best paying railroad of France, which, along the Riviera to Genoa and by means of a branch via the Mont Cenis tunnel to Turin, also controls the Italian trade.

The Saone is a peaceful stream; it winds through its valley, bordered by rich pastures on which graze large herds of cattle. Next to the meadows are broad fields of cereals and other crops; wheat is extensively grown, for France is a wheat-producing country. Where the ground is unproductive, forests prevail. On the hillsides and extending well into the valley are the vineyards; here is the home of Burgundy wine.

At Lyon the gentle Saone joins the wild Rhone, which, rushing down from the Alps, strikes at Lyons the hard sides of the Cevennes and is turned sharply toward the south. It flows close to the central highlands so that its right bank is high, the left usually level, except where the river has cut through the highland, detaching some of its spurs. Thus are produced picturesque narrows, which for beauty of landscape, challenge a comparison with the Rhine and the Hudson.

The Rhone is a rapid, turbulent stream, which carries an enormous load of sediment and makes shipping difficult not only because of the strong current but also because of the numerous and constantly shifting sand and gravel banks. Riding south on one of the peculiarly constructed steamers, you cannot escape the charm that lies in the thought and the feeling of passing from the cool, cloudy north to the warm, sunny south. As you proceed, the vegetation changes in character; in place of the Burgundian grape there is the mulberry tree, the foundation of the silk culture. When groves of olive trees appear, the river leaves the highland region and enters the sunny plains of Provence, the Provincia of the Romans. The olive marks the Mediterranean clime, for while the olive can stand the summer drought, it is extremely sensitive to frost. Olives and almonds, fruits and flowers are staple products in this land of blossoms and fragrance; for flowers are grown for their odors, Provence being prominent in the manufacture of perfumes. While the valley of the upper Rhone is a true valley of erosion the southern end is land made of the transported material, a filled branch of the Mediterranean. This making of land is proceeding, in that the river is steadily extending its delta. Above Arles the river divides into a greater and a lesser channel carrying about eighty-six per cent and fourteen per cent of the water respectively to the sea. The delta between is not as fertile as might be expected, because the rapid Rhone carries much coarse material to its very mouth; and much of the finer material is carried by a prevailing westward current of the Mediterranean and deposited along the shore of Languedoc. This material, together with the debris brought down by the small streams from the Cevennes, has, during historic times, considerably extended the coast line; thus Narbonne, the Narbo of the Romans, an important seaport in ancient days, is now several kilometers from the sea.

Throughout its course the Rhone is not favorable to navigation; at its mouth in a tideless sea, the shifting channel is dangerous; so that the beautiful and populous valley has no port of importance at its real outlet. The true

valley port to the east of the Rhone delta is Marseilles. One cannot but admire the prevision of the Greek colonists in selecting a site for their town when they founded Massilia.

Marseilles has a fine harbor beyond the reach of the silt that has ruined the ports to the west. It has an enormous import and export trade; it is the largest port of France and first in importance on the Mediterranean. Marseilles has been very materially benefitted by the opening of the Suez Canal, the results of French initiative and French ingenuity.

The most important and most populous French cities after Paris are in this valley; Marseilles, near the mouth of the Rhone, and Lyons where it is augmented by the Saone. Lyons is a beautiful city; it is the center of the silk industry in which it controls the world's market; it is strongly fortified and the seat of a university. Lyons is the old Lugdunum of the Romans. A large city was bound to rise on this site at the very center of the united valley, at the meeting of two navigable streams, and near the western gateway of Switzerland.

The efforts of the French to defend this valley proves its value to them. The divide between the Rhone and the Rhine, i. e., the pass between the Vosges and the Jura mountains bristles with forts, clustering around Belfort which made such an heroic defense in 1871. Wholly within the Saone valley lies Besancon, and at the meeting of the waters, Lyons, both fortifications of first rank. All the Alpine passes leading to Switzerland and Italy are guarded by forts; and not far to the east of Marseilles is Toulon, the war port of France.

MAN AND NATURE IN THE MAKING OF THREE GREAT HARBORS

By K. W. DAVIDSON,

Oshkosh, Wis.

WHEN good harbors were considered as dispensations of Providence New York harbor held a position of unquestioned supremacy in America. Now, when harbors depend so much on skillful improvement by man there is need for New York to adopt a comprehensive harbor-improvement policy if she is to maintain her supremacy. Her shore line is limited and is already inadequate for her great commerce. When Fulton proved that his steamboat was a success, the legislature of the state of New York passed a law which gave to "Robert Fulton, his heirs, and assigns forever the exclusive right to use steam upon the surface of New York Harbor and the Hudson River." The law was later declared unconstitutional, but it illustrates the difference between the policy of the time and of the present. Now the state and the city of New York are doing everything possible to make the harbor and wharves public property.

The harbor itself, the drowned valley of the Hudson, consists of two parts, the Lower and the Upper Bays. Lower Bay extends from Sandy Hook and Coney Island to the Narrows. The bay includes Sandy Hook, Raritan and Gravesend Bays, and gives 88 square miles of safe anchorage. Upper Bay, about four miles long and from two to two and three-quarters miles wide, extends from the Narrows to the Battery at the south end of Manhattan Island. This part of the harbor affords 14 square miles of safe anchorage. The combined anchorage of the two bays, which are open throughout the year, is over 100 square miles.

Admission to the Upper Bay is gained through four entrances. Through the main or south entrance (The Narrows) comes the majority of the foreign commerce. At the north are the Hudson and the East rivers, the former leading back into the hinterland and the latter into Long Island Sound. On the west, Kill von Kull affords an entrance from Newark Bay and Staten Island Sound. The main channel has been deepened to 35 feet. And there is now under construction from Sandy Hook to the docks in Upper Bay a channel 2,000 feet wide and 40 feet deep. A channel is also being excavated around the Brooklyn shore. This channel will be about four miles long, 1,200 feet wide, and 40 feet deep. The improvements to the harbor have already cost $25,000,000, and average yearly about $250,000. The latest great improvement to be undertaken is the Jamaica Bay Project. This involves the purchase of some 9,000 acres of marsh land, which will be built up with the material dredged from the channel, which is to be deepened to 50 feet in order to accommodate the greatest ocean vessels. This project will furnish about 150 miles of wharfage, and, when docks, warehouses, and terminal facilities are built, will cost, it is estimated, $13,000,000. The city of New York is receiving no aid from either the state or the federal government, except in the matter of dredging the channel.

The harbor of New York must take care of a yearly average tonnage of 15,000,000 tons, valued in 1910 at $1,587,000,000, and in 1911 at $1,654,000,000,—over 66 per cent of the national imports and over 40 per cent of the national exports. In addition to this great tonnage there is an immense amount of tonnage which is ferried about the harbor in the course of inter-state commerce. To handle this tonnage the system of piers and wharves is totally inadequate.

Since 1686, when through its charter the city was given the land around Manhattan Island between the high and low water marks, the city has been trying to get control of the water front. In 1870 the state gave it the title to the land as far as the Bronx. In 1871 the city similarly acquired the ownership of the water front along the Hudson. At the present time it owns all the North River frontage from 67th street to the Battery, and the East River frontage as far north as Corlean Hook Point, that is, three-fifths of the total water front. From long term leases of this frontage they derive a yearly in-

come of $3,500,000. In reality the greater part of the New York wharfage is controlled by the railroads. In the harbor there is a possibility of 475 miles of wharfage of which 125 miles can be used for ocean ships. At the present time about 300 miles have been improved, which give 55 miles of wharfage to ocean vessels.

The result of the lack of a comprehensive dock system is three fold: first, there are few "open piers," that is, piers open to the use of any ship; secondly, there is no segregation of the different classes of freight; and thirdly, the wharfage and terminals are so inadequate that 10,500 lighters must be used.

The only good terminals are those controlled by the Brush Terminal Company. This company owns 29 blocks of wharfage in South Brooklyn with a frontage of 3,120 feet. In controls six piers, 115 classified warehouses, and has terminal and spur railway tracks connecting with 10 different railways. Outside of this one instance there is no co-operation between water and rail transportation.

Liverpool

The conditions in the harbor of Liverpool are the reverse of those in New York. The harbor is the estuary of the Mersey River and is governed on such a broad, farsighted policy that it is more than able to care easily for the annual commerce of 10,000,000 tons.

In the construction of a suitable harbor two great obstacles had to be overcome. First a thirty-foot tide had to be conquered. Then the shifting sand bars and the great bar at the mouth of the Mersey had to be eliminated. This bar has been a great check to the use of the river at all tides, in spite of careful and scientific dredging. At present, however, a 35 foot channel is maintained which allows the continual use of the great protected river harbor.

The harbor dues, rates, fees, lights, dredging, and all improvements are under the absolute control of the Mersey Dock and Harbor Board. The board serves without pay, and membership in it is considered one of the highest honors that can be given to a Liverpool business man. The board receives no help from either the city or the government, but carries on its improvements by means of the income from its dock estates. This property is 1677 acres in extent and in addition to it the board controls an eighty-mile electric service between the sheds and quays. The income from the docks amounted in 1893 to $7,680,000, and represented the income from an outlay of $106,000,000.

The thirty foot tide has been overcome by a system of "wet docks" and floating landing stages. The landing stages are used chiefly by the liners. The largest stage is 2,478 feet in length and has railway connections at its shore end with all parts of the country. The "wet docks" are the most interesting feature of Liverpool's harbor. These are very similar to our locks. When a ship enters one of the docks, gates are closed behind it and thus a con-

stant water level is maintained, which greatly facilitates loading and unloading. In 1907 construction was begun on a dock which accommodates four ships at a time with lengths up to 1100 feet and of 120 foot beam. The construction of this dock cost $16,000,000. Its gates alone costing $8,000,000. In connection with the dock are great warehouses. The tobacco warehouse is 723 feet long, 165 feet wide and 13 stories high, with a capacity of 66,000 hogsheads. It is through improvements of this kind that the Dock and Harbor Board keeps several years ahead of the demands of shipping.

In 1908 Liverpool had 53 docks, 16 dry docks, and its quayage was 36 miles. All the construction work is of the most durable type. The quay walls are of masonry or concrete; the sheds and warehouses are of steel, stone or brick. The entire system of docks and warehouses are connected by an electric railway line,—which in turn connects with the national railway systems. Through the efforts of the Dock and Harbor Board everything about the harbor and docks is highly systematized, and water and rail are in cooperation.

Yokohama

Yokohama, the third great port to be considered, has an exceptionally fine harbor, due both to natural advantages and to extensive improvement. It is connected with the Bay of Tokyo by entrances from the northeast and from the southwest, but is otherwise entirely surrounded by land. Thus the high waves from the ocean are checked and do not disturb the harbor. The tide causes but slight inconvenience. The bottom of the harbor is a thick stratum of mud which affords a fine anchorage.

In 1889 the government started improvement work and by 1896 completed two breakwaters, a long iron pier, a retaining wall, and did a large amount of the required dredging. The breakwater which protects the southwest entrance to the harbor is a mile long; the one which protects the northeast entrance is still longer. Each entrance is 800 feet wide and 33 feet deep. The breakwaters, combined with a retaining wall for the regulation of the small river running into the bay, fully protects the 1270-acre harbor.

The government did not stop at these improvements, however. It kept on dredging, using six dredges and two rock cutters, until now two-thirds of the harbor has a depth of 35 feet. Fearing that the dockage would be too small the government built an island of 56 acres for new docks. Eleven steel sheds, with an area of 353,800 square feet and four warehouses with an area of 333,300 square feet were built. Railways connect all the buildings and the docks.

Recently an extensive plan of improvement was started. The new docks, with the latest loading appliances, have just been completed at a cost of $5,260,000. The dredging of the remainder of the harbor will be completed in 1914. Nevertheless, in spite of these extensive improvements, the harbor is still inadequate for its trade, and Japan is about to begin the construction of a new pier, special quay walls, and much larger docks.

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Professor W. M. Davis has recently been the recipient of foreign honors as marked as those accorded him by American scientists on the extended trip which he made in the west last winter. The Royal Dutch Geographical Society at Amsterdam has elected him to honorary membership as "Master in the art of organizing excursions in the old and the new world, and ingenious founder of a new system of geomorphology." The Paris Academy of Sciences has made him a correspondent in the Section of Geography and Navigation to take the place of the late Sir George Darwin.

LITTLE STUDIES IN CLIMATE

Frost

WE are not in the habit of regarding so small a climatic factor as the dates of the killing frosts of spring and fall, as important in the study of climate. These dates—the average date of the last killing frost in spring and the first in autumn—determine the expectable length of the growing-season and so exert a potent influence in determining what crops and fruits may be grown successfully in the region in question. Many crops and most fruits are sensitive to frost and can be commercially grown only in those places where the growing-season is regularly long enough to permit them to mature. Since cotton requires seven months or more between killing frosts it can be grown only in our southern states. Corn requires four or five months and can not be grown successfully in most parts of Canada. While the average annual temperature of Michigan and of Wisconsin is about the same, the former is one of our leading producers of fruit while the latter does not grow enough for its own people. The frost dates are, in a large measure, responsible for the difference.

In a bulletin on *Frosts in New York* Professor W. M. Wilson summarizes and illustrates the conditions affecting local temperatures and the dates of killing frosts.

1. *Night temperatures over cities are likely to be higher by four or five degrees than over the country, due in large part to the mantle of smoke which hangs above the city* and, like a cloud, prevents the escape of some of the heat which otherwise would pass off freely into space.

2. *At night, the air close to the surface of the ground is cooler than that a few feet above.* The difference on quiet nights may amount to as much as ten or fifteen degrees in as many feet, though usually less. Low-growing vegetation may freeze when tall plants and shrubs escape. Cold air is heavier than warm and so tends to rest close to the ground.

3. *Bodies of water—rivers, lakes and the ocean—modify the temperature of the air over them: this air is moved with the wind across the adjoining land and warms or cools it according as the body of water is warmer or cooler than the land.* This effect is very great in the case of Ireland, England, Norway, British Columbia, and southern Alaska, but much less in the case of Labrador or New England. One important reason why fruit growing is so successful in lower Michigan, Ontario, and western New York is this influence of the Great Lakes in retarding the spring and so preventing the opening of the fruit-buds before the danger of belated frosts has passed; and, in autumn, warding off the early frosts. This modifying effect of water bodies arises from a peculiarity of water; it warms and cools much more slowly than land. Under similar conditions land cools and warms five times as rapidly as water. The result is that bodies of water are cooler in spring than bodies of adjacent land and, in autumn, retain their heat longer. At the

same time these bodies of water restrict both spring and autumn frosts. On an average, the last severe frost of spring may be expected about May first in places near Lake Erie and Lake Ontario in New York, but it may be expected a week later, only a score of miles inland; and the first killing frost of autmun comes a week or two later along the lake shore than in places some distance from the lakes.

4. *Moderate elevations (e. g. hill slopes) are less likely to have injurious frosts than are the valleys immediately below.* By reason of what is known as air drainage, cold air, being heavier than warm, flows down the slopes and collects in the depressions of the land. The warmer air rests upon the cooler and bathes the hill slopes and lower hill tops and thus prevents frost. The following instance is recorded in England. "At the end of May, 1894, there was a frost in the interior of England. After the frost, the ash trees in the valley bottoms were completely frost-bitten; those that grew somewhat higher up on the slopes were frost-bitten below their crowns, but the crowns were green; those that grew on still higher ground had their lower halves frozen, but the upper halves were green; while the ashes growing on the hills surrounding the valley were not injured in the slightest degree." Orchards, vineyards, and gardens are therefore safer on *slightly* elevated land than in the low valleys.

5. *The exposure of slopes, whether to the north, east, south or west, affect liability to frost.* Hillsides exposed toward the south receive the sun's rays most effectively; next comes those facing east, then west, and finally, north. Consequently north slopes are most liable to frosts, then successively west, east and south slopes. The climatic conditions on the north and south slopes of the Pyrenees, Alps, and Caucasus mountains differ widely, and the vegetation and conditions of life differ accordingly.

6. *While the tops and slopes of low hills are less subject to untimely frosts than are the valley bottoms, a considerable elevation (say hundreds of feet) brings in a different situation.* The atmosphere, being mainly warmed by the heat returned by the earth, is colder at higher elevations, and so the growing season is shorter on the high lands. For example, in the central Adirondacks it is only one hundred days, in the high hills of the southern tier of counties one-hundred twenty to one-hundred forty days, and in the central plain and Mohawk Valley, one-hundred forty to one-hundred sixty days. For a combination of reasons it reaches two hundred days on the south shore of Long Island.

Methods of Frost Protection

"The object sought in all methods of frost protection is to hold the temperature of the air in contact with the plant above the point of danger. In the attempt to accomplish this certain principles are involved: 1. Prevention or retardation of the escape of heat from the earth by the use of an

artificial covering. The use of smudges as a means of protection against frost is based on this principle. 2. Addition to the air of moisture in the form of vapor, with the view of obtaining the effect of liberation of latent heat as the moisture condenses. The use of damp fuel for smudges and the spraying of fires with water have this purpose in view. 3. Heating the air by numerous small fires."

Artificial Covering. "It is a very old practice to protect plants from frost by covering them with newspapers, carpets, straw, and the like, but it is applicable in practice only to small areas."

Smudging. "In practice smudging has not proved a very efficient method of protection. It is used chiefly at present to shield the blossoms from the sun during the morning hours following a frost, thus preventing too rapid thawing. It is said that blossoms may be frozen solid for several hours without injury if thawed very slowly."

Heating the Air. "The most practical, efficient, and economical method yet devised for protection of large areas is the direct addition of heat by means of numerous small fires properly distributed over the area to be protected. The fuel to be used must be on the ground and ready for instant use. Moreover, it must be dry, so that fires may be started quickly when the temperature approaches the point of danger."

Does Orchard Heating Pay?

Hedrick says that during the past twenty-five years fruit was practically ruined by frost in western New York in four years--1889, 1890, 1895 and 1902. In four other years—1888, 1891, 1893 and 1903, the damage was considerable; while in three years—1892, 1896 and 1900, the damage was slight and confined to early fruits.

Experiments in western orchards show that it costs about $3.00 an acre a night to heat orchards, and that the apparatus costs about $20.00 an acre, but lasts many years. Wilson believes that New York fruit growers would profit by equipping their orchards with heating apparatus. R. H. W.

In his recent book entitled *Culture, Discipline and Democracy,* Prof. A. Duncan Yocum of the University of Pennsylvania several times touches upon the teaching of Geography. In one place he says: "The physiographical geography, which represents the swing of the pendulum from the equal extremes reached by the old geography of location, is also ripe for the pruning knife." He pleads for an emphasis on those facts which are "something to remember by and think with." The views on the teaching of geography set forth in this book by an educationist accord closely with those held by most of our leading geographers.

RECENT PUBLICATIONS

REPRESENTATIVE CITIES OF THE UNITED STATES. By Caroline W. Hotchkiss. XI+212 pages. 65 cents. Houghton Mifflin Company, Boston, 1913.

"The purpose of these studies," says the author, "is to offer to boys and girls in the grammar grades a fresh point of view in the final study of the United States." Fourteen cities are described and interpreted in a way that will appeal to children. The chapters are not merely descriptions. They are careful studies by a keen observer. The author spent a year in visiting and studying parts of the United States, including the cities which are described in the book. There are many illustrations. The appendix includes Review Exercises, Rules Governing the Location of Cities, Lists of Leading American and Foreign Cities, Seaports, Imports and Exports of Principal Countries, and many other kinds of geographical information. The author does not talk down to the children. Long experience in teaching them has fitted her to understand their interests and while writing in a natural way, to write in the language of children. The book is thoroughly to be commended.

GLOBES AND MAPS IN ELEMENTARY SCHOOLS, A TEACHERS' MANUAL. By Leon O. Wiswell. 63 Pages, cloth, 10 figs. 50 cents. Rand McNally and Co., Chicago, 1913.

A little hand book, giving a series of elementary exercises in mathematical geography and planned to train pupils in the use of maps and the globe. There are a dozen globe exercises for grades 4, 5 and 6, nearly as many more for grades 7 and 8, and an equal number suited to lower classes in the secondary school. There is also a group of ten exercises dealing with the purpose, the reading, sketching and drawing of maps, and their care. The manual closes with a suggested course of map lessons. It does not presuppose any expensive equipment, and will aid materially in making clear the use and meaning of maps, and in teaching the fundamentals of mathematical geography.

LUCITA, a Child's Story of Old Mexico. By Ruth Gaines, with pictures by Maginel Wright Enright, pp. XII+115. Rand, McNally and Co., 1913.

This little book has the advantage of having been written by a most sympathetic and careful observer who has seen what she describes. Her little heroine, Lucita, is a real girl and most of the incidents and scenes impress you as genuine. There are a number of fine pictures in colors. The book makes an interesting supplementary reader for the primary grades.

TOPICAL OUTLINE FOR THE STUDY OF IMPORTANT COUNTRIES

1. SITUATION:

Is it favorably situated with respect to

a. latitude? (compare with some part of N. A.)

b. the sea, particularly for commerce?

c. other progressive nations?
d. ease of defense against enemies?
e. ability to get easily the most needed imports?

2. COMPARATIVE SIZE AND POPULATION; (compared with some familiar area). To what extent is its size an advantage or disadvantage? Why? Is it densely populated? (compare with U. S. and with home state).

3. CLIMATE:

Is the climate (including rainfall) favorable for
(a) agriculture? Any special kind?
(b) mental and bodily vigor?
(c) fruit growing? What kinds?

Any notable peculiarities of climate? Causes?

4. SURFACE FEATURES:
(a) Relative proportions of lowlands and highlands?
(b) Are the lowlands well suited to agriculture? Why or why not?
(c) Are the uplands useful? For what? To what extent?
(d) Do the surface features have any marked influence upon the climate of the country? Explain.
(e) In a broad sense, how has the surface of the country affected its developments?
(f) What important mountains are in the country or on its borders?
(g) Summarize main points?

5. COAST WATERS, RIVERS, LAKES:
(a) Name its important coast waters, rivers, lakes.
(b) Is the coast favorable for ocean commerce? Explain.
(c) To what extent are its rivers used for (a) navigation, (b) irrigation, (c) waterpower? Are they connected by canals?
(d) What and where are its important harbors?
(e) Are its lakes (a) numerous? (b) noted for beauty? (c) commercially important?

6. NATURAL RESOURCES:
(a) Extent of agricultural lands?
(b) Extent and importance of forests?
(c) Importance of fisheries?
(d) Most valuable minerals? Has it an abundance of coal and iron?
(e) Is it, generally speaking, rich in mineral resources? (compare with some familiar country)
(f) Summarize main points.

7. CHIEF INDUSTRIES:
(a) To what extent are the people engaged in agriculture?
(b) Is agriculture a leading or a secondary industry?
(c) Does the country produce a surplus or deficiency of food?
(d) What are the leading crops and why?

(e) Is mining relatively important or unimportant? fishing? grazing? lumbering? fruit growing?
(f) How does the country rank in manufacturing (high? medium? low?) Why?
(g) In what phases of manufacturing, if any, does it take high rank? Why?
(h) Does the government actively encourage industries? How?
(i) Under what disadvantages are certain industries carried on?
(j) Are its leading industries intelligently carried on? Explain.
(k) Compare the wages and the efficiency of labor with those in the United States.

8. TRANSPORTATION FACILITIES:
(a) Well or poorly developed? Explain.
(b) Any peculiarities in methods of transportation? What? Account for them.

9. PEOPLE, GOVERNMENT, RELIGION, LANGUAGE, EDUCATION:
(a) What race? What branch of the race? (Slav, Germanic, Latin, etc.)
(b) Kind of government? Quality of government?
(c) Prevailing religion? Is there freedom of religion?
(d) Language or languages spoken?
(e) Educational conditions?
(f) Do the people live under generally favorable or unfavorable conditions? Explain.

10. CITIES:
(a) Capital?
(b) Chief ports?
(c) Other important cities and their location? (not many)
(d) Matters of considerable importance in connection with any cities?

11. FOREIGN TRADE:
(a) Comparative volume (compared with that of some familiar country).
(b) Character of exports (foodstuffs, manufactures, raw materials etc.)
(c) Character of imports? Reasons?
(d) Chief items of import and export? (few)

12. MISCELLANEOUS MATTERS:
In connection with any important country there are matters of interest that fall under no general classification. Mention some such in connection with the country under discussion.

13. GENERAL QUESTIONS:
(1) Why does this country hold a high position among nations? or why does it not?

(2) In what particulars does it excel most other countries? What do travelers go there to see?
(3) In what directions is it making most notable progress?
(4) Has it any important colonies? Where?
(5) Can you see the reason why this country is great or is not great?
(6) In connection with this country, what points stand out most prominently in your memory?

BRIEFER OUTLINE

1. SITUATION:
   Point out advantages and disadvantages of its situation.
2. SIZE AND POPULATION:
   Compare with some other well known country.
3. CLIMATE, INCLUDING RAINFALL:
   Favorable and unfavorable features of climate, and effect upon people and industries.
4. SURFACE FEATURES:
   In what way do they exert an influence upon the industries and general development of the country?
5. COAST WATERS, RIVERS, LAKES:
   Name the principal ones. Character of the coast line and influence upon commerce? Usefulness of rivers to man?
6. NATURAL RESOURCES:
   What are they? Are they of great value? Show why.
7. CHIEF INDUSTRIES:
   Are they more closely related to the resources of the country or to its stage of development?
8. PEOPLE, GOVERNMENT, RELIGION, LANGUAGE, EDUCATION.
9. CHIEF CITIES, location and why they are important.
10. IMPORTANCE AND CHARACTER OF FOREIGN TRADE.
11. MISCELLANEOUS MATTERS OF INTEREST.
12. SUMMARY of the most important reasons for the position or rank of this country among the nations.

R. H. W.

REVIEW QUESTIONS IN GEOGRAPHY

Compiled by LOUISE W. MEARS,
Milwaukee State Normal School, Department of Geography

ASTRONOMICAL

1. What is meant by saying that the earth is a planet?
2. Name the planets other than the earth.
3. What common relation do all the planets bear to the sun?
4. What three characteristics do all the planets have in common?

5. What is the solar system?
6. What is the Copernican theory of the solar system?
7. What is the Nebular Hypothesis?
8. What is the planetesimal theory of the earth's origin?
9. What is the shape of the earth?
10. Give five proofs of the earth's shape.
11. What was Aristotle's belief concerning the earth's shape?
12. What was Columbus' belief concerning the earth's shape?
13. Why does the earth appear flat to us?
14. Name some advantages to man on account of the earth's shape.
15. Compare the conditions on a cubical earth with the conditions on a spherical earth.
16. What disadvantages would arise in case the earth were as large as Neptune?
17. What effects has the shape of the earth upon the angularity of the sun's rays?

The Seasons

18. Define axis.
19. Define poles.
20. What is the size of the earth? Diameter? Circumference?
21. How many and what motions has the earth? Cause?
22. What does each motion of the earth cause?
23. In what direction does the earth rotate?
24. In what direction does the earth revolve?
25. What determines a year on any planet?
26. What is the shape of the earth's orbit?
27. What are the causes of the change of seasons?
28. What two conditions concerning the position of the earth's axis never change?
29. How many degrees of the earth's surface are lighted at one time?
30. What is meant by the plane of the earth's orbit?
31. What would be the effect if the earth's axis were perpendicular to the plane of its orbit?
32. In our summer, what is the temperature condition at the poles?
33. Where does the vertical ray of the sun fall in our summer?
34. When does summer begin in the southern hemisphere?
35. What places on the earth's surface have the same length of day and night as Milwaukee?
36. What determines the width of the zones?
37. In what season of the northern hemisphere is the earth farthest from the sun?
38. What is meant by the equinoxes?
39. When is the summer solstice?

40. When is the winter solstice?
41. When are the days and nights equal everywhere?
42. Where are there truly four seasons of the year?
43. When does the sun's vertical ray fall upon the Tropic of Concer?
44. At what time of day is your shadow shortest?
45. In what direction does your shortest shadow fall?
46. In what direction does your shadow fall in the evening?
47. Where on the earth's surface would there be no shadow at noon?
48. When does the sun rise directly in the east and set directly in the west?
49. How do you account for the days being longer than the nights in our summer?
50. Why does the sun's vertical ray never fall in latitudes higher than 23½ degrees?

LATITUDE

51. How is absolute geographical position determined?
52. What are parallels on the globe?
53. Which four parallels have special names?
54. Of what use are geographical circles?
55. What is latitude?
56. What is the length of a degree of latitude?
57. What are the highest latitudes which can be reached?
58. What points on the earth have no latitude?
59. What is the width in degrees of each temperate zone?
60. What is the width in degrees of the torrid zone?
61. How broad are the frigid zones from pole to circle?
62. What countries (not continents) are crossed by the equator?
63. What is the latitude of the Antarctic circle?
64. What is the latitude of the North Pole?
65. In what zones does North America lie?
66. In what zones does each of the other continents lie?
67. Between what parallels does your state lie?
68. What is the latitude of Milwaukee; Chicago; New York; San Francisco; Sitka; Cape Sable (Florida); Gibraltar (Spain); Point Barrow (Alaska); North Cape (Europe)?
69. Which is farther north, Sitka or St. Petersburg?
70. Which is farther north, London or Quebec?
71. Is Iceland in the north temperate or north frigid zone?
72. Name the large cities that lie near the 40th parallel, north latitude.
73. Which continent extends farthest south?
74. Two cities about 690 miles apart, on the same meridian are located in latitude 42 degrees north and 32 degrees north respectively. From these

facts determine approximately the polar circumference of the earth. (From Elements of Geography. Salisbury, Barrows and Tower.)

75. Roald Amundsen, discoverer of the South Pole, established his first base of supplies in 80 degrees south latitude. How far, in miles, was he then from the South Pole?

76. Amundsen traveled 700 miles from the ice-front to the South Pole. How many degrees of latitude did he traverse?

77. Amundsen spent three days at the South Pole. In what directions could he look from this point?

78. Mawson, an explorer, reached the Magnetic South Pole in latitude 72 degrees, 25 minutes South. How many miles is the magnetic pole from the geographical or physical pole?

79. Where is the Magnetic North Pole?

80. Peary, in making his journey to the North Pole, traveled over the frozen ocean from 83 degrees north latitude. How many miles did this portion of the trip cover?

LONGITUDE

81. State the difference between parallels and meridians.

82. What is longitude?

83. What point on the earth has neither latitude nor longitude?

84. If Amundsen followed a route southward between the meridians 163 and 170 West Longitude, what continent was he south of?

85. What is the relation between longitude and time?

86. Why should all places on the same meridian have the same local time?

87. How many minutes difference in time for every degree difference in longitude?

88. If a man's watch indicates 2:30 p. m. when his shadow lies due north, what direction is he traveling from the prime meridian?

89. What is standard time?

90. Name the Time Belts in the United States.

91. Name a city in each Time Belt.

92. The President of the United States was inaugurated in Washington at high noon on March 4. What time was it by the clock in your city?

93. Where and what is the International Date Line?

94. What is the longitude of Washington, D. C.?

95. What is the longitude of Milwaukee?

96. What is the longitude of Cape Spear, Newfoundland?

97. What is the longitude of Bering Strait?

98. The 90th Meridian would be in what Time Belt in the United States?

99. What states are crossed by the 100th meridian?

100. What is the literal meaning of A. M. and P. M.?